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WALNUT SEED SOFT ROT SURVEY IN TWO MIDWEST
NURSERIES, 1981

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INTRODUCTION

In the fall of 1979, 700,000 walnut seeds were planted at the Wilson Nursery, Boscobel, Wisconsin. At the typical germination rate of 50 percent (Brinkman 1974), the expected crop was 350,000 seedlings. However, the germination rate in 1980 was 20 percent. Upon examination, many of the non-germinated seed were found to contain bacterial soft rot.

Because of this soft rot, fewer than 150,000 seedlings were available for outplanting in Spring 1981. At 11 cents per seedling, the difference between expected and realized crop value was \$22,000.

Following the discovery of the high amount of soft rot, researchers at the University of Wisconsin began investigating the cause (Leach et al. 1980). Several species of bacteria were isolated from the symptomatic nutmeats. These were limited to two genera, Pseudomonas and Erwinia. Subsequent inoculation of healthy walnut seed with these isolates reproduced some of the soft rot symptoms observed at the nursery.

As part of our cooperative pathology effort with Wisconsin Department of Natural Resources, Forest Pest Management conducted a survey for walnut seed soft rot in two additional nurseries: Iowa State at Ames, Iowa and General Andrews at Willow River, Minnesota. These nurseries were selected because General Andrews Nursery had walnut cultural practices similar to those used at Wilson Nursery while the Iowa State Nursery did not.

OBJECTIVES

The objectives of this survey were 1) to determine if walnut seed soft rot is occurring in other nurseries of the region, and, 2) to determine if particular seed and seedbed preparation practices are associated with high levels of walnut seed soft rot.

MATERIALS AND METHODS

Walnut Samples

Percent germination, seed lot origin, and seed bed density were determined for the sample beds at each nursery. Four samples, each consisting of 50 nuts, were taken within the sample beds. At the Iowa State Nursery one sample contained only 32 nuts. The sample nuts were non-germinated and did not include those detached from seedlings. A small number of nuts were examined from the Wilson Nursery for the purpose of comparison.

Each nut was cracked and examined for nutmeat condition. Five categories were used to describe the contents:

- Apparently healthy
- Empty
- Fungal decay - molded
- Bacterial decay - "cheesy"
- Bacterial decay - "soupy"

These categories correlated with those used by the Wisconsin group to describe nutmeat condition at the Wilson Nursery (Kuntz 1981).

Cultural Practices

A summary of nursery practices associated with walnut culture at each nursery was made. The following information was obtained:

- seed preparation prior to planting (husking, etc.)
- seed bed treatment prior to planting (fumigation, additives, etc.)
- seeding method and depth
- time of year seeded

RESULTS

Walnut Seed Samples

Percent of seed germination at the Iowa State and General Andrews Nurseries was quite close (40 and 45 percent, respectively) (Table 1). However, the percent of walnut seed with decay at the same two nurseries was substantially different (28 and 71 percent, respectively) (Table 2). Overall, the condition of the walnut samples taken at the General Andrews and Wilson Nurseries was very similar and contrasted with the condition of the samples taken at the Iowa State Nursery.

TABLE 1
Walnut Stock 1981

Seedbed History	Iowa State	General Andrews	Wilson ^{2/}
Seed origin	Dubuque	SE MN	SW WI
Seeds/bed ft. ^{1/}	60	44	42
Seedlings/bed ft.	24	20	11
Percent germination	40	45	26

^{1/} Seedbeds were 4 ft. wide. Therefore, 1 bed ft. equals 4 ft².

^{2/} Personal communication, Richard Camp, Manager, Wilson Nursery, Boscobel, WI.

Cultural Practices

The nursery practices associated with walnut culture at each of the nurseries are summarized in Table 3. At each nursery, walnut is a one year crop that is fall seeded. The primary differences between nurseries were in the manner of seed preparation and seeding. Unlike the General Andrews and Wilson Nurseries, Iowa State did not husk its seed, cover the seed with soil, or fumigate the walnut beds.

TABLE 3
Nursery Practices Associated with
Walnut Culture

Cultural Practice	Iowa State	General Andrews	Wilson
Seed preparation	None	Dehusk	Dehusk
Bed treatment prior to seeding			
Physical	Rototiller	Rototiller	Disk in cover crop
Amendments	P, Potash	Lime, Potassium	Lime
Fumigation	None	Vapam	Methylbromide, (ilC-33®) ^{1/}
Seeding method	Broadcast on surface, rolled and mulched with corn cobs	Drilled, 2-2.5" deep, hydro mulched	Trenches, 3" deep
Time of year seeded	Fall	Fall	Fall

^{1/}The use of trade, firm, or corporation names is for the information and convenience of the reader. Such use does not constitute an official evaluation, conclusion, recommendation, endoresement, or approval of any produce or service to the exclusion of others which may be suitable.

DISCUSSION

Similarity in percent germination at the General Andrews and Iowa State Nurseries, but differences in percent colonization of non-germinated nuts by microorganisms (Table 1), suggests that differences in nursery cultural practices are affecting colonization of these non-germinated nuts.

A review of the walnut cultural practices at the three nurseries indicated that both the General Andrews and Wilson Nurseries dehused their seed while the Iowa State Nursery did not. The dehusing process can result in mechanical damage to the seed coat. These damaged areas may provide entry courts for nutmeat colonization by microorganisms present in the nursery soils or on the partially decomposed husks. Preliminary results from the University of Wisconsin research team have indicated that there is no increase in nutmeat decay when husked and non-husked nuts are compared following winter cold storage (Kuntz 1981). However, the nuts in this test were not overwintered in soil.

TABLE 2
Walnut Seed Condition
by percent

Sample		Total nuts	Apparently healthy	Empty	Moldy	Bacterial Soft Rot			Total Nuts w/decay	Misc. ^{1/}
Nursery	Date					"Cheesy"	"Soupy"	Total		
Iowa State General	6/17/81	182	66	6	8	14	6	20	28	---
Andrews	6/26/81	200	12	18	15	30	26	56	71	---
Wilson	7/13/81	54	3	29	17	26	17	43	59	8

^{1/} These nuts had dried contents that may have previously been "soupy". They did not have a moldy appearance or odor.

While none of the nurseries sows their walnut seed identically, both the General Andrews and Wilson Nurseries covered their seed with soil as opposed to the mulching procedure followed at the Iowa State Nursery. It is possible that mulching alters the microclimate surrounding the seed in such a manner as to reduce microorganism colonization of nutmeats.

It should be noted that different seed lots were used at each nursery and that observed decay rates may reflect this difference in seed lot rather than differences in nursery practices. Similarly, differences among nursery soils can be expected to alter the microclimate surrounding the nuts and therefore the microflora.

CONCLUSIONS

Walnut soft rot, as noted in 1980 at the Wilson Nursery in Boscobel, WI., is not unique to that nursery. Cultural practices such as husking and seeding technique may be associated with increased incidence of this problem.

RECOMMENDATIONS

A single seed lot should be evaluated for effect of husking and sowing technique on percent microbial colonization, specifically bacterial soft rot.

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